The Degradational History of Endeavour Crater, Mars.

J. A. Grant[1], T. J. Parker[2], L. S. Crumpler[3], S. A. Wilson[1], M. P. Golombek[2], and D. W. Mittlefehldt[4],

Smithsonian Institution, NASM CEPS, 6th at Independence SW, Washington, DC, 20560 (grantj@si.edu),
[2]Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109,
[3]New Mexico Museum of Natural History & Science, 1801 Mountain Rd NW, Albuquerque, NM, 87104,
[4]Astromaterials Research Office, NASA Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058.

Endeavour crater (2.28°S, 354.77°E) is a Noachian-aged 22 km-diameter impact structure of complex morphology in Meridiani Planum. The degradation state of the crater has been studied using Mars Reconnaissance Orbiter and Opportunity rover data. Exposed rim segments rise ~10 m to ~100 m above the level of the embaying Burns Formation and the crater is 200-500 m deep with the southern interior wall exposing over ~300 m relief. Both pre-impact rocks (Matijevic Formation) and Endeavour impact ejecta (Shoemaker Formation) are present at Cape York, but only the Shoemaker crops out (up to ~140 m) along the rim segment from Murray Ridge to Cape Tribulation.

Study of pristine complex craters Bopolu and Tooting, and morphometry of other martian complex craters, enables us to approximate Endeavour's pristine form. The original rim likely averaged 410 m ±200 m in elevation and a 250-275 m section of ejecta (±50-60 m) would have composed a significant fraction of the rim height. The original crater depth was likely between 1.5 km and 2.2 km.

Comparison between the predicted original and current form of Endeavour suggests ~100-200 m rim lowering that removed most ejecta in some locales (e.g., Cape York) while thick sections remain elsewhere (e.g., Cape Tribulation). Almost complete removal of ejecta at Cape York and minimal observable offset across fractures indicates current differences in rim relief are not solely due to original rim relief. Rim segments are embayed by ~100-200 m thickness of plains rocks outside the crater, but thicker deposits lie inside the crater.

Ventifact textures confirm ongoing eolian erosion with the overall extent difficult to estimate. Analogy with degraded Noachian-aged craters south of Endeavour, however, suggests fluvial erosion dominated rim degradation in the Noachian and was likely followed by ~10s of meters modification by alternate processes. Such degradation is consistent with 1) the interpretation of a pediment on the rim flanks of Endeavour, 2) the formation of features such as Marathon Valley, 3) the nearly complete removal of ejecta at Cape York, 4) preservation of a thicker section of ejecta at Cape Tribulation and perhaps, 5) the origin of some gaps in the rim around the crater. A paucity of debris shed from the rim indicates most degradation occurred prior to embayment by the plains rocks.